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An Empirical Analysis of the Postwar Savings and Loan Industry

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AN EMPIRICAL ANALYSIS OF THE POSTWAR

SAVINGS AND LOAN INDUSTRY

John E. Spencer

March 17, 1967

AN EMPIRICAL ANALYSIS OF THE POSTWAR
SAVINGS AND LOAN INDUSTRY*

John E. Spencer

1. Introduction

Since the war Savings and Loan Associations (SLA's) have grown more rapidly than the other major financial institutions. In this study, using annual data, I have attempted to outline the main factors which influenced the SLA industry during the period 1947-1964.

SLA's borrow short and lend long. They attract deposits from the general public by offering a competitive rate of interest and by advertising, and they invest most of their funds in 1-4 family mortgages at a rate of interest which is fixed at the time of the closing of the loan. These loans are generally extended for a period of about 20-25 years and are repaid in equal monthly installments. The margin between the mortgage rate (m) and the rate on deposits (i) is the main source of net income for the associations.

This paper considers nation-wide averages and totals only; it does not attempt to deal with the considerable variations in market conditions

* This paper was written while the author was visiting the Cowles Foundation for Research in Economics at Yale University as a Henry Fellow and Fulbright Scholar on leave from the Queen's University of Belfast. The study has benefited from discussion with Donald Hester, James Tobin and Thayer Watkins. Discussion with C. St. J. Oherlihy on Building Societies in the United Kingdom was also of much value. I am responsible for remaining errors and shortcomings. Computation was carried out at the Yale Computer Center under a grant from the National Science Foundation allocated by the Department of Economics at Yale.

which are known to exist between regions. It does not separate F. H. A. and V. A. mortgages from the conventional loans, and it does not distinguish between mutual and stock associations.

SIA's have grown fairly continuously during the twentieth century except for the early 1930's when the depression had a strong effect. Mortgage repayments were not being fully made and many foreclosures took place, so that by 1936 real estate represented more than 20 percent of total SLA assets [10, p. 7]. Withdrawals had reached peak levels in 1933 and 1934 and SLA's were unable to liquidate real estate assets as rapidly as savers wanted funds. Many associations failed and savers lost about \$200 million [10, p. 141], the worst year being 1933. SLA assets fell from nearly \$9 billion in 1930 to less than \$6 billion in 1935.

In 1932 the establishment of the Federal Home Loan Bank (FHLB) System, which made funds available to SLA's, helped to restore public confidence in the associations. In 1934 the Federal Savings and Loan Insurance Corporation (FSLIC) was set up by Congress. This also helped in restoring public confidence, as it insured the savings accounts of those SLA's which were members. All SLA's operating under federal charters are required to be members, state SLA's may be. By the end of 1947, 74.6 percent of all SLA assets were owned by insured associations; by the end of 1964 the figure had risen to 96.2 percent [18, p. 123]. The Federal Home Loan Bank System provides "a central credit facility that supplements the resources of its member institutions." It "serves as a source of secondary liquidity to member institutions in meeting heavy or unusual withdrawal demands. It supplies funds to smooth out the differences between the contraseasonal flow of savings and the

closing of construction and home purchase loans. It supplements local lending resources in capital-deficit areas by helping to shift funds from capital-surplus areas" [18, p. 109]. All federally chartered SLA's are required to be members of the system, qualified state-chartered associations may be. By the end of 1947, 89.2 percent of total SLA assets were owned by members; by the end of 1964, 98.4 percent were member owned [18, p. 111].

By the late 1930's SLA's were recovering from their difficulties. The real estate market improved, SLA holdings of real estate were reduced substantially, loan volume regained strength and construction lending was given new emphasis [10, p. 8].

During the war SLA's were faced with a surplus of funds to invest. Repayments on mortgages were steadily flowing in, but most private home building had ceased and there was severe competition for loans on existing properties. After the war, SLA's had ample liquid funds and were faced with a renewed demand for mortgage loans, and the movement has been expanding rapidly ever since. The rest of the paper will analyse this period of growth.

2. By the end of 1964 the SLA national balance sheet was as follows: [18, pp. 92 and 95].

(2.1)	M	+	L	+	R.E.	+	B.S.	+	E ^(iv)
	101.314		10.998		.625		1.227		5.131
=	S	+	B	+	K	+	L.I.P.	+	E ⁽ⁱⁱⁱ⁾
	101.847		5.596		7.903		2.221		1.728

The variables are in units of \$ billion and are defined as:

- M = gross mortgage assets.
- L = liquid assets, which are made up of cash, including bank deposits, and U.S. government securities.
- R.E. = real estate owned.
- B.S. = FHLB stock held by SLA's*
- $E^{(iv)}$ = other assets
- S = stock of deposits held.
- B = FHLB advances.
- K = reserves and undivided profits.
- L.I.P. = loans in process.
- $E^{(iii)}$ = other liabilities.

(2.1) can be written as:

$$M + (L - B) + E^{(ii)} = S + K + E^{(i)}$$

i.e.,

$$(2.2) \quad M + L^1 + E^{(ii)} = S + K + E^{(i)}$$

where

$$L^1 = L - B$$

$$E^{(ii)} = R.E. + B.S. + E^{(iv)}$$

$$E^{(i)} = L.I.P. + E^{(iii)}$$

* Members of the FHLB system are required to hold FHLB stock equal to or greater than a proportion of total loans. Since January, 1962, the figure has been 1 percent. Further details can be found in [18, p. 114].

In equation (2.2) I subtract B from L to get a figure of "net" liquid assets, L^1 . For the purposes of this paper an increase in borrowing from the FHLB system is assumed to be equivalent to a running down of liquid assets.

It is true that there is a required minimum liquidity ratio ($\frac{L}{S}$) set by the FHLB Board, so that if the actual ratio is close to the legal minimum, SLA's may well prefer to increase FHLB borrowing rather than reduce their liquid holdings. However, in the period under consideration the difference between the actual and the required liquidity ratios has never fallen below 3.8 percent, so that it seems reasonable to assume that SLA's will consider a decrease in liquidity and an increase in borrowing as equally undesirable. If liquidity is low they will tend to increase the rate of interest paid on deposits, or reduce the mortgage rate, unless the problem is taken to be short run or seasonal. It is policy of the FHLB System to charge interest rates on their lending which bear a proper relationship to dividend rates paid by SLA's in order to avoid excessive use of their credit. I assume that the interest payments due to increased FHLB borrowing are about the same as the interest receipts lost by reducing liquid asset holdings by the same amount as the additional borrowing. This approximation is considered sufficient in the present context.

Equation (2.2) can be rewritten as:

$$(2.3) \quad M + L^1 + E^0 = S + K$$

where

$$E^0 = E^{(ii)} - E^{(i)} = 6.983 - 3.949 = 3.034.$$

Taking first differences we have

$$(2.4) \quad \dot{\Delta M} + \Delta L^1 + \Delta E^0 = \Delta S + \Delta K$$

Also, $\Delta M = A - R$

$\Delta S = D - W$

where A = mortgage advances (gross) by SLA's.

R = repayments of mortgage loans (excluding interest repayments) to SLA's.

D = gross deposits (including dividends credited to accounts) received by SLA's.

W = withdrawals from the stock of savings deposits held by SLA's.*

$R + D$ constitutes the inflow of capital each year, $A + W$ constitutes the outflow. In addition to these flows of principal there are flows of interest receipts and payments, advertising and management expenses, etc. which determine each year's profit or addition to reserves.

The final form of the incremental balance sheet identity can now be written:

$$(2.5) \quad A - R + \Delta L^1 + \Delta E = D - W + \Delta K$$

These seven variables, together with the mortgage rate (m), the dividend rate (i) and the level of SLA advertising (V), give us ten endogenous variables to be explained by the model.

* There is a slight discrepancy between $D - W$ and ΔS which I am unable to eliminate.

Stochastic equations for $\frac{A}{P_H}$, $\frac{R}{P_H}$, $\frac{\Delta E}{P}$, $\frac{D}{P}$, $\frac{W}{P}$, m , i and $\frac{V}{P}$ have been computed, where P is the consumer price index and P_H is the price of houses. These equations, with the balance sheet identity and an expression for the increase in reserves, ΔK , make up the complete model. A modification of the method of two stage least squares is used to derive the estimates. This modification is discussed below in Section 4.

3. We begin by considering what variables should affect the demand of the public for mortgage advances. Advances have been divided by the price of houses (P_H), where the Boeckhe index of residential construction costs is used as a proxy for P_H . (For a justification of this proxy, see the comments of R. F. Muth in 13, pp. 83-89.) We expect real advances to be influenced positively by the number of housing units started ($\frac{H}{P_H}$), relative rents ($\frac{\text{Rents}}{P}$), where a rent index has been taken as a percentage of the consumer price index (P), real income ($\frac{Y}{P}$), the rate charged by Mutual Savings Banks on their mortgage loans ($m(\text{MSB})$), real advertising by SLA's ($\frac{V}{P}$), and negatively by the relative price of houses ($\frac{P_H}{P}$) and the rate charged on advances by SLA's (m).

Why should the demand for advances be affected by the number of housing starts? It is due to the method of financing the new house. When a construction firm decides to build a house it may go to a SLA for a short term advance. The SLA will then put a sum of money in the loans in process account and this sum will be drawn upon as the building progresses. The SLA mortgage portfolio will then increase, ultimately by the amount lent to finance the new house. When the building is finished the construction

firm may sell the house and repay the loan to the SLA, and the purchaser of house may then take out a new advance from the SLA. In this case, two loans would be reported for financing the one property. Alternatively, the purchaser may simply assume the original loan made to the builder [4, pp. 57 and 286; 11, pp. 158-163].

The estimated equation turned out to be as follows, where the t-ratios are written under the coefficients*:

$$(3.1) \quad \frac{A}{P_H} = 17.89 + .00373 \left(\frac{H}{P_H} \right) - .2336 \left(\frac{P_H}{P} \right) + .05011 \frac{Y}{P}$$

$(2.01) \quad (3.52) \quad (1.41) \quad (1.38)$

$$+ .1313 \left(\frac{V}{P} \right) - 2.085 m.$$

$(2.88) \quad (2.94)$

$R^2 = .9891$
 $d = 1.588$
 $SE = .6646$

Both $\frac{\text{Rents}}{P}$ and $m(\text{MSB})$ had coefficients of the expected sign but had t-ratios which were less than one. Hence they were dropped from the equations.

* Four of the eight stochastic equations contain only predetermined variables among the regressors and they have been estimated by ordinary least squares. Their coefficient standard errors have been derived in the usual way. The other four equations were estimated by two stage least squares (see below) and their estimated asymptotic variance-covariance matrices were derived using as divisor the number of observations (18) rather than the number of degrees of freedom in the equation. I refer to the coefficients divided by their standard errors as t-ratios in both cases.

constant	$\frac{H}{P_H}$	$\frac{P_H}{P}$	$\frac{Y}{P}$	$\frac{V}{P}$	m	$\frac{\text{Rents}}{P}$	m(MSB)
12.88 (.94)	.004001 (3.00)	-.1914 (.80)	.0355 (.80)	.1410 (2.74)	-2.380 (2.65)	.04156 (.52)	.3755 (.50)
17.66 (1.93)	.003677 (3.37)	-.2653 (1.52)	.0440 (1.15)	.1394 (2.91)	-2.168 (2.94)	.05373 (.75)	--- ---
17.89 (2.01)	.003730 (3.52)	-.2336 (1.41)	.05011 (1.38)	.1313 (2.88)	-2.085 (2.94)	--- ---	--- ---

The coefficients have signs as expected and are of reasonable orders of magnitude. If the relative price of houses rises by one percentage point, the demand for real advances falls by \$233.6 million (all money magnitudes which have been converted into real terms in the model are measured in 1957-1959 dollars). The elasticity of demand for advances with respect to the price of housing is 1.98 with a standard error of 1.40.

If real income rises by \$1,000 million, real advances will tend to rise by about 5 percent of that amount, other things being equal. The income elasticity turns out to be about 1.29 with a standard error of .94. The point estimate implies that the ratio of advances to income tends to rise with income.

If the mortgage rate rises by one percentage point, say from 4 percent to 5 percent, the demand for real advances falls by \$2,085 millions. Other cost variables such as the loan to value ratio, the down payment required and the length of the mortgage should also determine mortgage demand. To the extent that m is serving as a proxy for these other cost variables, its coefficient could be biased. For example, if all the terms were tightened at the same time as the mortgage rate, the coefficient would be too large in absolute value. I do not have sufficient data on the terms of the mortgages to say whether or not this is so. The elasticity with respect to the mortgage

rate is .98 with a standard error of .33. Thus any reasonable confidence interval straddles the value unity. We return to this below.

The housing coefficient implies that, cet. par., the construction of a new house will have the effect of increasing the demand for mortgages by 3,730 1957-1959 dollars. This is taken to mean that SLA's tend to finance about one-sixth of new private housing units.

The advertising coefficient seems to mean that an extra million of real dollars spent on advertising will increase the demand for advances by about 130 million dollars. However, the advertising figures relate to all advertising and not just to loan promotion, as I was unable to separate the figures adequately. In recent years the U.S. Savings and Loan League have organized annual surveys* on advertising which throw some light on the problem. These sample surveys are not unbiased as they report on some three or four hundred associations "selected from among the most aggressive merchandisers in our business."

The breakdown of the figures from 1960 to 1964 are as follows:

Percentage Distribution of Advertising Outlay by Type of Service Advertised			
<u>Savings Promotion</u>		<u>Loan Promotion</u>	<u>Other</u>
1960	68.7%	6.3%	25.0%
1961	67.3	9.4	23.3
1962	59.4	11.0	29.6
1963	57.2	20.8	22.0
1964	<u>56.5</u>	<u>18.2</u>	<u>25.3</u>
	61.8	13.1	23.0

Source: U.S. Savings and Loan League

* The surveys are published under the title of "Advertising Budgets" and were brought to my attention by Mr. H. Dahlberg and Mr. E. J. Bracken of the First Federal SLA of New Haven during discussion. The figures quoted above are reproduced with the permission of the League.

Other advertising is composed of institutional or image building expenditure, public relations and special events spending. Presumably expenditure in any one category will have some effect on both savings and loan promotion, but it would seem that our coefficient on $\frac{V}{P}$ in the advances equation will be biased downward, perhaps by a factor of two or three. Nothing definite can be said, however, especially as the survey results indicate that the loan promotion figure varies widely.

Repayments of principal are assumed to be dependent on advances lagged over time as follows:

$$(3.2) \quad R = aA + bA_{-1} + sA_{-2} + s^2bA_{-3} + \dots$$

where the variables are expressed in current dollar terms. This can be rewritten as $R = (b-as) A_{-1} + sR_{-1} + aA$, neglecting problems connected with the residuals. Dividing through by the price of houses we have $\frac{R}{P_H}$

$$= (b-as) \frac{A_{-1}}{P_H} + s \frac{R_{-1}}{P_H} + a \frac{A}{P_H},$$

which is the form in which the equation

was estimated. It was found to be:

$$\frac{R}{P_H} = .5890 \frac{R_{-1}}{P_H} - .0476 \frac{A_{-1}}{P_H}$$

(3.14) (.48)

+ .3007 $\frac{A}{P_H}$, SE = .2865. Dropping $\frac{A_{-1}}{P_H}$ on the grounds that its coefficient is not significantly different from zero, we find:

$$(3.3) \quad \frac{R}{P_H} = .5126 \frac{R_{-1}}{P_H} + .2943 \frac{A}{P_H}, \quad R^2 = .9853$$

(5.09) (6.13)

$$\text{SE} = .2931$$

$$d = .948$$

This gives $\hat{s} = .51$, $\hat{a} = .29$, $\hat{b} = .15$. Of course, we expect a to be larger than b due to the changing house effect. Each year many people move house and take out a new mortgage, the repayment on the existing mortgage being financed by selling their old house. This will lead to large repayments of principal in the current period. The coefficients in (3.2) represent the net effect of two factors. Firstly, any advance closed, say fifteen years ago, may contribute nothing to current repayments,

it having been prepaid sometime during those fifteen years. The average life of a mortgage is well under ten years. A counter to this effect is that repayments of a new mortgage will at first mainly be composed of interest payments, so that, ceteris paribus, $A(1963)$ will contribute proportionately less to $R(1964)$ than $A(1958)$, say.

The demand for SLA deposits measured at 1957-1959 prices is assumed to be positively correlated with real income, real advertising and the dividend rate offered by SLA's. It is assumed to be negatively correlated with competing rates of interest and stock yields. The competing rates are assumed to be the rate offered by Mutual Savings Banks, $i(\text{MSB})$; the rate on Commercial Bank time deposits, $i(\text{CB})$; the rate on U. S. Government bonds, $i(\text{US})$; the yield on Aaa bonds, $i(\text{Aaa})$; the rate on preferred shares, $i(\text{P})$; and the dividend yield on shares, $i(\text{CS})$. I assume that people allocate their funds with respect to absolute rates of interest, rather than first differences in rates. Last year's rate of change of prices is included in the equation on the grounds that the real rate of interest is equal to the money rate less the rate of change of prices, $\frac{dP}{dt}/P \cdot E^{-1} \left(\frac{\Delta P}{P} \right)_{-1}$ is taken to be the best guide that people have as to the current year's rate of change of prices, (E is the shift operator).

After experimentation the equation turned out to be:

$$\begin{aligned}
 (3.4) \quad \frac{D}{P} = & \frac{-34.91}{(3.99)} - \frac{5.692}{(2.58)} i(\text{MSB}) - \frac{3.382}{(5.65)} i(\text{Aaa}) \\
 & + \frac{.0812}{(1.77)} E^{-1} \left(\frac{\Delta P}{P} \right)_{-1} + \frac{.1065}{(5.39)} \left(\frac{Y}{P} \right) + \frac{.0685}{(1.21)} \left(\frac{V}{P} \right) \\
 & + \frac{13.66}{(3.24)} i
 \end{aligned}$$

$R^2 = .9938$
 $SE = .4843$
 $d = 1.503$

There were some problems of collinearity among the interest rates so that the interpretation of the coefficients is not straightforward. The yield on high quality long term bonds, $f(Aaa)$, was highly correlated with $i(US)$, their correlation coefficient being 0.9960.

The table below sets out some of the results of the experimentations.

constant	$i(MSB)$	$E^{-1}(\frac{\Delta P}{P})_{-1}$	$\frac{Y}{P}$	$i(Aaa)$	$i(US)$	$i(CS)$	i	$\frac{V}{P}$
-46.80 (2.59)	-8.254 (1.83)	.06690 (.79)	.1407 (3.29)	2.672 (.65)	-7.266 (1.50)	.1157 (.22)	17.64 (1.95)	.03072 (.25)
-47.60 (2.65)	-8.514 (1.93)	.06337 (.75)	.1420 (3.31)	2.675 (.64)	-7.361 (1.50)	--- ---	18.50 (2.24)	.01791 (.17)
-34.91 (3.99)	-5.692 (2.58)	.08120 (1.77)	.1065 (5.39)	-3.382 (5.65)	--- ---	--- ---	13.66 (3.24)	.06852 (1.21)
-42.88 (3.21)	-7.470 (2.23)	.07116 (1.05)	.1279 (4.26)	--- ---	-4.329 (4.17)	--- ---	16.98 (2.62)	.03592 (.42)

Including $i(CS)$, we find that its coefficient is neither of the expected sign nor significantly different from zero. Dropping $i(CS)$ yielded the second equation of the table. Keeping advertising in the equation on the grounds of strong a priori opinion, I drop $i(Aaa)$ and $i(US)$ separately. When $i(US)$ is dropped the coefficient of $i(Aaa)$ becomes of the correct sign and possesses a strong t-ratio. Dropping $i(Aaa)$ to get the fourth equation of the table, we find the coefficient of $i(US)$ is of expected sign though smaller in absolute value than its coefficient when $i(Aaa)$ is

included. Its t-ratio strengthens considerably. The third equation is finally chosen over the fourth with the variable $i(\text{Aaa})$ representing the point effect of $i(\text{Aaa})$ and $i(\text{US})$. When $i(\text{CB})$ is introduced, its coefficient was of incorrect sign and insignificant. The rate on preferred shares does not seem to have any effect.

If $E^{-1} \left(\frac{\Delta P}{P} \right)$ is having the desired effect of allowing for the difference between money rates and real rates, we expect that $.08120 - [-5.692 - 3.382 + 13.66]$ will not be significantly different from zero.

If i_j represents the j th money rate, then $\alpha_1 (i_1 - \Delta) + \alpha_2 (i_2 - \Delta) + \alpha_3 (i_3 - \Delta)$ represents the sum of the real rates times their coefficients where $\Delta = E^{-1} \left(\frac{\Delta P}{P} \right)$. I rewrite this as $\sum_{j=1}^3 \alpha_j i_j - \Delta \sum_{j=1}^3 \alpha_j$ and test

if $\sum_{j=1}^3 \hat{\alpha}_j = \hat{\beta}$, where $\hat{\beta}$ is the estimated coefficient of Δ .

We find that
$$\frac{\sum_{j=1}^3 \hat{\alpha}_j - \hat{\beta}}{\hat{S} \left(\sum_{j=1}^3 \hat{\alpha}_j - \hat{\beta} \right)} = 1.44$$
. This ratio would have been

considerably smaller but for the relatively large negative covariance between the coefficients of $i(\text{MSB})$ and i of -6.84 . The test is, of course, a very inconclusive one but it is tentatively accepted that people take real rates into account when they try to balance their portfolios, $\left(\sum_{j=1}^3 \hat{\alpha}_j - \hat{\beta} = 0 \right)$.

The equation implies that the SLA dividend rate has a very strong positive effect on deposit demand. An increase in i of one percentage point will raise the demand by 13 or 14 billion real dollars. This supports evidence cited in 9, pp. 33-36, that an increase in the dividend rate will have a strong positive effect on growth.

There has been a good deal of discussion attempting to explain the postwar popularity of SLA deposits. For example, Alhadeff and Alhadeff [1]

consider aggressive advertising and the safety, liquidity and convenience of SIA deposits all relevant. They also stress the fact that a new generation of savers had arrived who had more favourable attitudes towards the riskiness of share accounts than those who remembered the depression experience. I tried to measure this latter effect by using the percentage of SIA assets which were insured by the FSLIC but a negative and insignificant coefficient was obtained. Werboff and Rozen [19] point out that attitudes need not have changed; with the passing of time, people can see the favourable experience of SIA savers and it is concluded that the consistently higher interest rate offered by SIA's is the important explanatory factor. Anyhow, to the extent that time is working in favour of SIA's, other things being equal, the coefficients of the variables in the equation may be somewhat biased; in particular, the real income coefficient may be biased upward. This coefficient implies that about ten percent of an increase in real income will be channelled into SIA deposits, the elasticity with respect to real income being 1.95 with a standard error of .36. As real income increases the share of SIA deposits in income rises. The coefficient of income is to be interpreted as a short run coefficient and is to be compared with fairly high estimates of the short run marginal propensity to save which have been derived elsewhere. It is also a reflection of the domination of the deposit type of financial institutions in the flows of savings. When time is included in the equation its coefficient is negative and insignificant. Perhaps some nonlinear function of time would help.

The equation suggests that the main source of competition comes from MSB's and U.S. Savings Bonds. (It might be argued that there is a case

for treating MSB's endogenously in the model. This complication was not attempted.) Over the period CB's do not seem to have been strong sources of competition. They were, of course, subject to a ceiling on their time deposit rate, and it may not be in their own interests to seriously compete with SLA's etc. for savings deposits anyhow [see 2, pp. 63-64 and 3].

What about the effect of advertising? An increase in deposit advertising of \$1 million will increase receipts by more than the \$68.5 million suggested by the equation for the reason given above in connection with advances. Of course, the standard error associated with the advertising coefficient is much too large for comfort. However, if we assume that 20% of advertising is spent on loan promotion, 60% on savings promotion, we could make estimates of the profitability of advertising. Suppose advertising for deposits rises by \$1 million. Then deposits rise by about \$113 million. These could all be turned into mortgages for an additional \$.3 spent on loan promotion. Taking $m-1 = 2.28\%$, the average margin, we find that the extra \$113 million will add over \$3.1 million to net interest receipts, which yields a surplus of over \$1.8 million. It seems probable that it pays to advertise.

We come now to the equation explaining withdrawals. $\frac{W}{P}$ is assumed to be a linear function of interest rates, real income and the stock of deposits outstanding at the end of the previous period. It is expected that advertising has no effect on withdrawals. One would also expect that there would be a certain amount of inertia concerning withdrawals and that the interest rates would not have coefficients as large as those in the gross deposits equation. We find:

$$\begin{aligned}
 (3.5) \quad \frac{W}{P} = & \frac{1.149}{(1.82)} i(\text{MSB}) + \frac{.7085}{(2.33)} i(\text{US}) - \frac{.03812}{(1.95)} E^{-1} \left(\frac{\Delta P}{P} \right) \\
 & + \frac{.2867}{(35.36)} \left(\frac{S}{P} \right)_{-1} - \frac{1.557}{(2.83)} i \quad R^2 = .9989 \\
 & SE = .2255 \\
 & d = 2.379
 \end{aligned}$$

Real income was found to have an insignificant coefficient and was dropped from the equation as were the constant term and the rate on preferred shares for the same reason.

Trying the same interest rates that were successful in the gross deposits equation yields:

$i(\text{Aaa})$	$i(\text{MSB})$	$i(\text{US})$	$i(\text{CS})$	$E^{-1} \left(\frac{\Delta P}{P} \right)_{-1}$	$\left(\frac{S}{P} \right)_{-1}$	i
-2.006 (2.26)	.9916 (1.29)	2.803 (2.81)	-.02027 (.21)	-.02879 (1.43)	.2801 (28.25)	-1.198 (1.28)
-2.014 (2.25)	1.086 (1.75)	2.839 (2.86)	-----	-.02782 (1.41)	.2812 (33.84)	-1.354 (2.48)
.4283 (1.48)	1.236 (1.86)	-----	-----	-.03858 (1.85)	.2876 (33.32)	-1.409 (2.39)
-----	1.149 (1.82)	.7085 (2.33)	-----	-.03812 (1.95)	.2867 (35.36)	-1.557 (2.83)

Dropping the dividend yield on shares, $i(\text{CS})$, leads to the second equation in the table. Here we find that the coefficient $i(\text{Aaa})$ is of incorrect sign. Dropping $i(\text{US})$ has the effect of changing the sign of the coefficient of $i(\text{Aaa})$, though the latter becomes barely significant. In the fourth equation of the set we see the effect of retaining $i(\text{US})$ and dropping $i(\text{Aaa})$. This equation is finally chosen over the third one, as it has a lower standard error of estimate; .2255 compared with .2379. In the equation $i(\text{US})$ is taken to represent the joint effect of U.S. Government

bond and Aaa bond yield changes.

Performing the same test on the interest rate coefficients and the lagged rate of price change coefficient, we find that the relevant t-ratio works out at about 1.02. Hence we conclude again that the sum of the interest rate coefficients is not significantly different from the price change coefficient. It is tentatively concluded that people take the real rate into account when making withdrawals. As in the deposits equation, a relatively large negative covariance between the coefficients of i and $i(\text{MSB})$ increased the value of the t-ratio substantially.

Advertising was found to be unimportant in the explanation of withdrawals. Its coefficient was of unexpected sign (positive) but insignificant with a t-ratio of .67. The lagged rate of change of stock prices was unsuccessful in both the withdrawals and deposits equations.

If we accept the point estimate of the advertising coefficient in the deposits equation and both the coefficient estimates of the SLA dividend rate in the deposits and withdrawals equation, what can we say about the merits of the two different ways of increasing deposits? Assuming 60% of advertising is spent on savings promotion, we have seen that it will cost \$1 million to increase net deposits by \$113 million. If advertising were to remain constant, it would require an increase in the dividend rate of 0.00934% to increase net deposits by the same figure. At the mean savings balance this implies an increase in dividend payments by nearly \$4 million. Hence advertising seems to be a cheaper method of increasing deposits than raising the dividend rate.

All the equations we have been discussing are demand equations with

the exception of repayments which were explained by a mechanical process. It is assumed that SLA's satisfy these demands fully, adjusting interest rates or advertising where necessary rather than employing artificial rationing. They are subject to earnings and liquidity constraints which we discuss below. It is assumed that they desire to work on as large a scale as possible, subject to these constraints.

The increase in reserves each year can be approximately written as follows:

$$\Delta K_t = I_t^M - I_t^D + I_t^L - V_t - ME_t$$

where

I_t^M = interest on the mortgage portfolio

I_t^D = interest paid on the stock of deposits

I_t^L = interest received on securities

V_t = advertising expenses

ME_t = management expenses, which I write below as a constant fraction of savings deposits at the start of year t ,
i.e., bS_{t-1}

We can rewrite the equation as:

$$(3.6) \quad \Delta K \approx A_t \cdot \frac{m_t}{2} + \bar{m}_{t-1} (M_{t-1} - \frac{1}{2} R_t) \\ - i_t [S_{t-1} + \frac{1}{2} (D_t - W_t)] + I_t^L - V_t - b \cdot S_{t-1}$$

\bar{m}_{t-1} is the average rate of return on the mortgage portfolio in the previous

period and $\frac{A_t}{2} \cdot m_t$ is the interest inflow on current advances (see notes on m in the Appendix). The interest inflow has to be separated into two expressions as m is fixed and unalterable at the time when the loan is closed. Hence a currently high mortgage contract rate will not affect the interest inflow on old mortgages. The expression assumes that the flows of principal are evenly distributed throughout the period. Seasonal indices could be used to adjust for this, if desired.

Writing $\left(\frac{K}{S}\right)_t = k_t$ we have that

$$k_t - k_{t-1} = \frac{\Delta K_t}{S_t} - \frac{\Delta S_t}{S_t} \cdot k_{t-1}$$

Hence $\Delta k_t > 0$ if $\frac{\Delta K_t}{K_{t-1}} > \frac{\Delta S_t}{S_{t-1}}$.

Normally it is difficult to increase the reserve ratio. Such considerations restrict growth and over the period there has been a tendency for k to fall. We note that I^m and I^D are the most important determinants of ΔK .

In the determination of the interest rates it is assumed that net liquidity and reserves play a dominant role. We expect, if liquidity is low and/or borrowing high, i.e., if net liquidity is low, that either or both of the rates on deposits and on mortgages will be raised. Writing $\left(\frac{L'}{S}\right)_{t-1} = \ell'_{t-1}$, we expect that it will have a negative coefficient in each equation (a low net liquidity at the end of the previous period leads to higher rates this period). As regards the effect of changing the mortgage rate upon reserves, the situation is more complicated, and should crucially depend on the elasticity with respect to the interest rate in the advances equation.

If $|E_m(\frac{A}{P_H})| > 1$ a lowering of the mortgage rate would be the appropriate policy if reserves are low. If m in the advances equation is serving as a proxy for other costs, then a general easing of terms would be indicated. However, we saw above that the estimated elasticity turned out close to 1. Hence on elasticity considerations, we cannot make a judgment as to the expected sign of k_{-1} in the m equation.

A change in the dividend rate will have a very strong effect on SLA interest payments to depositors. If i falls, say by one-half of one percent, I_t^D will fall by a large amount and net deposits will also fall. If mortgages are not to be rationed, then m will have to rise by an amount substantially more than the fall in i , other things being equal. This will not affect the interest received on old mortgages in the current period and will probably have little effect on interest received on new advances. So if reserves were low at the end of last period, appropriate policy would seem to be to lower the dividend rate [see 18, p. 97]. Hence we expect k_{-1} to have positive coefficient in the i equation.

The computed equations were:

$$(3.7) \quad i = \frac{.1711}{(.97)} + \frac{1.005}{(24.49)} i_{-1} - \frac{.007414}{(1.34)} \ell'_{-1} .$$

$$R^2 = .9893, SE = .07062, d = 2.051$$

$$(3.8) \quad m = \frac{8.757}{(2.85)} + \frac{.3187}{(1.56)} m_{-1} - \frac{.5259}{(1.80)} k_{-1} - \frac{.0545}{(1.87)} \ell'_{-1}$$

$$R^2 = .7623$$

$$SE = .3751, d = 2.105$$

In each case the net liquidity coefficient is of the expected sign. The lagged interest rates were included as we do not expect that interest rates will be drastically changed from period to period. Also they help remove the upward trend in each rate which would not be properly explained by ℓ'_{-1} and k_{-1} . The coefficient on k_{-1} in the dividend rate equation was negative, contrary to hypothesis, but its t ratio was less than one so it was dropped. It seems that when reserves are low, SLA's tend to push up the mortgage rate. The net liquidity coefficients indicate that SLA's increase the mortgage rate more than the dividend rate when in liquidity difficulties.

The advertising equation was estimated to be:

$$(3.9) \quad \frac{V}{P} = \frac{63.32}{(1.36)} - \frac{6.041}{(1.14)} k_{-1} - \frac{.6416}{(1.37)} \ell'_{-1} + \frac{1.412}{(12.76)} \left(\frac{S}{P}\right)_{-1}.$$

$$R^2 = .9788$$

$$SE = 6.061$$

$$d = 1.625$$

where advertising is measured in millions of 1957-59 dollars. It is assumed that advertising will tend to rise with the size of the industry which is measured by the lagged stock of real deposits. It should also be affected by the situation with respect to reserves and net liquidity. There are serious difficulties of interpretation due to the inability to separate the different types of advertising. E.g., if net liquidity was low last year we should expect advertising for deposits to rise and that for advances to fall. Our negative and significant coefficient on ℓ'_{-1} indicates that advertising as a whole will be large if net liquidity is low. Perhaps this is a reflection of the fact that most of advertising is spent on deposits

promotion. If deposit advertising rose and mortgage advertising fell by the same proportionate amounts then total advertising would rise. The negative coefficient on k_{-1} , if regarded as significant, means that SLA's consider that an increase in advertising expenses will add enough to reserves to make it worthwhile. Due to the separation problem I am unable to say with confidence whether or not this is so. However, it does seem from the example above on the profitability of advertising that the negative sign is the probable one.

Our advances and deposits equations, together with the survey figures on advertising imply that a dollar spent on loan promotion advertising has a stronger effect than a dollar spent on advertising to increase deposits. This clearly implies that ℓ'_{-1} should have a negative coefficient, thus reinforcing the argument above,* but in order to justify a negative k_{-1} coefficient, more information on the composition of V is necessary.

ΔE , taken in money terms, is a residual in the incremental balance sheet equation. I divide by P and assume the resulting ratio is a function of time.

$$(3.10) \quad \frac{\Delta E}{P} = \frac{.1497}{(2.90)} + \frac{.02249}{(2.27)} t \quad \begin{array}{ll} R^2 & = .2439 \\ SE & = .2179 \\ d & = 2.272 \end{array}$$

We make up the complete system with the identity

$$(3.11) \quad \left(\frac{A}{P_H}\right) \cdot P_H - \left(\frac{R}{P_H}\right) \cdot P_H + \Delta L' + \left(\frac{\Delta E}{P}\right) \cdot P = \left(\frac{D}{P}\right) \cdot P - \left(\frac{W}{P}\right) \cdot P + \Delta K.$$

* See also 18, p. 103-105 where it is stated that total advertising fell by \$12 million in 1963 as SLA's "sought to moderate the inflow of savings."

4. Two points remain to be discussed. First, there is the problem of replacing the endogenous variables on the right hand side of each equation by instruments which are uncorrelated in the probability limit with the residuals of that equation and correlated with the variables they replace. In the model above there are 15 lagged endogenous and exogenous variables. As there are only 18 observations on each variable, the normal 2SLS procedure of regressing each endogenous variable on the right hand side on all the predetermined variables in the system is suspect. In this case the calculated instruments would be so close to the original endogenous variables that the 2SLS estimates would be almost the same as those derived by ordinary least squares. To avoid this difficulty the instruments were computed by regressing each right hand side endogenous variable on a subset of the predetermined variables in the system. The subset was selected such that the selected predetermined variables are closely correlated with the variable being replaced, are relatively uncorrelated among themselves and are relatively uncorrelated with the equation disturbance term. For a discussion of this problem see Fisher [8]. Predetermined variables appearing in the given equation are strong candidates for inclusion, as are variables in the equation explaining the endogenous variable to be replaced. Other things being equal, lagged endogenous variables are less strong candidates than truly exogenous variables. The final selection, though still somewhat arbitrary, is believed to be reasonable. It is as follows:

$$\hat{m} [\text{constant}, \frac{H}{P_H}, \frac{P_H}{P}, \frac{Y}{P}, k_{-1}, \ell'_{-1}, i(\text{US}), i(\text{Aaa})]$$

$$(\frac{\hat{V}}{\hat{P}}) [\text{constant}, E^{-1} (\frac{\Delta P}{P_{-1}}), k_{-1}, \ell'_{-1}, i(\text{US}), t, \frac{Y}{P}, \frac{H}{P_H}, \frac{P_H}{P}]$$

$$\hat{i} [\text{constant}, E^{-1} (\frac{\Delta P}{P_{-1}}), k_{-1}, \ell'_{-1}, i(\text{US}), i(\text{MSB}), \frac{Y}{P}]$$

$$(\frac{\hat{A}}{\hat{P}_H}) [\text{constant}, \frac{H}{P_H}, \frac{P_H}{P}, t, \frac{Y}{P}, k_{-1}, \ell'_{-1}]$$

The four values of R^2 are, respectively, 0.9201, 0.9846, 0.9909, .9818.

The second problem concerns the serial correlation of the residuals of each equation. If we bring our values of d , the Durbin-Watson Statistic, to the tables in the Durbin and Watson paper (Biometrika, Vol. 38, 1951, pp. 159-177), we find that 4 of our 8 stochastic equations have a value of d in the inconclusive range at the 2% level of significance (using a 2-tailed test). The four are the equations explaining advances, repayments, deposits and withdrawals. The evidence rejects autocorrelation at this level of significance in the equations explaining m , i , $\frac{V}{P}$, $\frac{\Delta E}{P}$.

The evaluation of the d -statistic in a simultaneous model which includes lagged indogenous variables among the regressors (even if only used to calculate an instrument for an endogenous variable) is not clear. In this paper, the model is assumed free of serial correlation.

APPENDIX^{*}

	A	R	D	W	m	i
1946	3.584	1.829	3.144	2.005	4.574	2.363
1947	3.811	2.116	3.399	2.240	4.203	2.382
1948	3.607	2.169	3.878	2.731	4.780	2.433
1949	3.636	2.331	4.433	2.987	4.796	2.509
1950	5.237	3.237	5.307	3.820	4.994	2.517
1951	5.250	3.354	6.406	4.327	4.924	2.585
1952	6.617	3.811	7.843	4.759	4.901	2.691
1953	7.767	4.226	9.425	5.783	5.180	2.807
1954	8.969	4.838	11.073	6.657	5.106	2.866
1955	11.256	5.990	13.481	8.590	5.205	2.933
1956	10.323	5.958	15.304	10.298	5.250	3.025
1957	10.159	5.909	16.429	11.664	5.899	3.261
1958	12.183	6.525	18.481	12.418	5.740	3.373
1959	15.151	7.637	21.792	15.188	5.737	3.528
1960	14.306	7.377	24.413	16.854	6.609	3.847
1961	17.364	8.600	27.682	18.988	6.433	3.907
1962	20.754	10.818	31.253	21.739	6.548	4.063
1963	24.735	12.561	35.607	24.610	5.489	4.155
1964	24.505	14.135	38.190	27.661	6.395	4.236

* All interest rates are expressed in percentages.

	M	S	V	ℓ'_{-1}	k_{-1}	P_{CS}
1947	8.971	9.753	9.6	25.07	8.77	30.7
1948	10.409	10.969	12.3	18.03	8.84	31.5
1949	11.714	12.471	14.6	13.94	8.87	30.9
1950	13.714	13.992	17.5	14.78	9.15	37.3
1951	15.610	16.107	21.3	10.80	9.02	45.3
1952	18.416	19.195	26.1	11.02	8.64	49.7
1953	21.957	22.846	30.9	11.11	8.32	50.1
1954	26.088	27.252	35.9	10.38	8.03	60.2
1955.	31.354	32.142	43.0	11.13	7.96	82.1
1956	35.719	37.148	54.8	8.88	7.94	86.4
1957	39.969	41.912	62.9	9.57	8.02	89.0
1958	45.627	47.976	67.8	9.42	8.01	93.7
1959	52.141	54.583	81.2	10.34	8.05	116.3
1960	60.070	62.142	93.7	7.83	8.02	113.2
1961	68.834	70.885	105.7	8.17	8.05	134.3
1962	78.770	80.236	114.2	8.00	8.13	126.4
1963	90.944	91.308	134.5	7.30	7.90	141.6
1964	101.314	101.847	124.5	5.92	7.76	164.9

	ΔK	ΔE	$\Delta L'$	$i(\text{MSB})$	$i(\text{CB})$	$i(\text{US})$	$i(\text{Aaa})$	$i(\text{CS})$	$i(\text{P})$
1947	.104	-.047	-.385	1.62	0.90	2.25	2.61	5.13	3.79
1948	.114	.053	-.230	1.66	0.90	2.44	2.82	5.78	4.15
1949	.137	-.037	.315	1.82	0.90	2.31	2.66	6.63	3.97
1950	.174	-.007	-.332	1.90	0.90	2.32	2.62	6.27	3.85
1951	.173	.093	.264	1.96	1.10	2.57	2.86	6.12	4.11
1952	.205	.125	.357	2.31	1.10	2.68	2.96	5.50	4.13
1953	.243	.104	.240	2.40	1.10	2.94	3.20	5.49	4.27
1954	.286	-.091	.662	2.50	1.30	2.55	2.90	4.78	4.02
1955	.370	.174	-.179	2.64	1.40	2.84	3.06	4.06	4.01
1956	.393	.335	.699	2.77	1.60	3.08	3.36	4.07	4.25
1957	.413	.534	.394	2.94	2.10	3.47	3.89	4.33	4.63
1958	.482	-.125	1.012	3.07	2.21	3.43	3.79	4.05	4.45
1959	.548	.325	-.687	3.19	2.36	4.07	4.38	3.31	4.69
1960	.590	.415	.805	3.47	2.56	4.01	4.41	3.60	4.75
1961	.725	.063	.592	3.55	2.76	3.90	4.35	3.07	4.66
1962	.812	.200	.190	3.85	3.14	3.95	4.33	3.37	4.50
1963	.689	-.037	-.451	3.96	3.33	4.00	4.26	3.17	4.30
1964	.694	.860	-.007	4.09	3.47	4.15	4.40	3.00	4.32

	$\frac{Y}{P}$	m(MSB)	H/P _H	P _H	P	Rents	$E^{-1}(\frac{\Delta P}{P}_{-1})$
1947	218.0	4.187	1265	69.5	77.8	68.7	8.453
1948	229.8	4.062	1344	78.2	83.8	73.2	14.412
1949	230.8	4.598	1430	76.2	83.0	76.4	7.712
1950	249.6	3.494	1908	80.3	83.8	79.1	-0.955
1951	255.7	3.799	1420	86.6	90.5	82.3	0.964
1952	263.3	3.721	1446	88.8	92.5	85.7	7.995
1953	275.4	4.339	1402	90.4	93.2	90.3	2.209
1954	278.3	4.655	1532	89.7	93.6	93.5	0.757
1955	296.7	4.489	1627	92.4	93.3	94.8	0.425
1956	309.3	4.923	1325	96.5	94.7	96.5	-0.321
1957	315.8	5.036	1175	98.3	98.0	98.3	1.501
1958	318.8	5.497	1314	99.2	100.7	100.1	3.485
1959	333.0	5.802	1495	102.5	101.5	101.6	2.755
1960	340.2	6.041	1230	104.2	103.1	103.1	0.794
1961	350.7	6.360	1285	104.5	104.2	104.4	1.576
1962	367.6	6.186	1439	106.3	105.4	105.7	1.067
1963	380.6	5.968	1582	108.5	106.7	106.8	1.152
1964	406.5	6.403	1531	111.6	108.1	107.8	1.233

Variables: definitions, units and sources

- A = gross advances in units of \$1,000 million; [18, p. 64].
- R = repayments of mortgage loans excluding interest, in units of \$1,000 million; [18, p. 64].
- D = gross deposits including dividends credited to accounts, in units of \$1,000 million; [18, p. 22].
- W = withdrawals of principal, in units of \$1,000 million; [18, p. 22].
- m = mortgage contract rate of interest (see note below).
- i = rate of interest paid on deposits (see note below).
- M = gross stock of mortgages held by SLA's at the end of the year in units of \$1,000 million [18, p. 64].
- S = stock of savings deposits held by SLA's at the end of the year in units of \$1,000 million [18, p. 95].
- V = advertising expenditures of SLA's in units of \$ million (see note below)
- $$l'_{-1} = \left[\frac{\text{liquid assets less borrowing from the FHLB Board}}{\text{stock of savings deposits}} \right]_{-1}$$
- $$= \left[\frac{L - B}{S} \right]_{-1} = \left[\frac{L'}{S} \right]_{-1}$$
- $$k_{-1} = \left[\frac{\text{reserves and undivided profits}}{\text{stock of savings deposits}} \right]_{-1}$$
- $$= \left[\frac{K}{S} \right]_{-1}$$

[L , B and K are given in 18, p. 95 and 92].

- P_{CS} = Standard and Poor's Index of Common Stock Prices, taken from 12, p. 18 and 15, p. 473, with 100 = 1957-59.
- ΔK = increase in reserves and undivided profits in the period in units of \$1,000 million [derived from 18, p. 95].
- ΔE = increase in a residual, defined as $\Delta E = D - W + \Delta K - A + R - \Delta L'$. Units are \$1,000 million.
- $i(MSB)$ = rate of interest paid by Mutual Savings Banks [National Association of Mutual Savings Banks, N.Y.].
- $i(CB)$ = rate of interest paid on time deposits by Commercial Banks [18, p. 16].
- $i(Aaa)$ = Moody's Corporate Aaa bond yield series [5, p. 248].
- iCS = dividend yield on 200 stocks (Moody's Investors' Service). [16, p. 107 and 17, p. S-21].
- $i(US)$ = Yield on U.S. Treasury bonds (taxable) [16, p. 106 and 17, p. S-20].
- $iCS(P)$ = dividend yields on 14 high-grade preferred stocks (Standard and Poor's Corporation) [16, p. 108 and 17, p. S-21].
- $\frac{Y}{P}$ = personal disposable income measured at 1957-59 prices and in units of \$1,000 million [Derived from 17, Table 5, p. 33].
- $m(MSB)$ = contract rate on mortgages charged by Mutual Savings Banks (see note below).
- H/P_H = New Private Nonfarm Housing Units started in thousands of units [15, Table No. 1088, p. 752].
- P_H = Boeckhe Index of Residential Construction Cost (1957-59 = 100) [18, p. 44].
- P = All item consumer price index (1957-59 = 100) [15, Table No. 494, p. 361].
- Rents = Index of Rents (1957-59 = 100) [15, Table No. 494, p. 361].

Further Notes on the Data

(1) m

Data for the interest rate charged on new mortgages by SLA's are not available except for 1963 and 1964 [see 6, pp. 20-21]. However a formula for the rate was derived as follows:

$$m_t = \frac{1}{\bar{A}_t} \left\{ I_t^m - \bar{m}_{t-1} (M_{t-1} - \bar{R}_t) \right\}$$

I_t^m = the interest received in period t from mortgages.

$\bar{m}_{t-1} (M_{t-1} - \bar{R}_t)$ = the interest received by SLA's on mortgages not advanced in the current year t, where \bar{m}_{t-1} = the average rate of return on the mortgage portfolio in year t - 1. \bar{R}_t is a weighted average of quarterly repayments of principal in period t, i.e., $\bar{R}_t = \frac{7}{8} (R_{1,t}) + \frac{5}{8} (R_{2,t}) + \frac{3}{8} (R_{3,t}) + \frac{1}{8} (R_{4,t})$, where $R_{i,t}$ is the value of repayments in the ith quarter of the tth year, so that $(M_{t-1} - \bar{R}_t)$ is a weighted average of the mortgage portfolio in period t, not including new additions to mortgage balances. For a given I_t^m , if repayments were very heavy in the first quarter, e.g., then m_t would be higher than if the repayments were evenly distributed over the four quarters. The weights

are declining; if $\bar{R}_t = \frac{\sum_{i=1}^4 R_{i,t}}{4}$ was used, m_t would be underestimated under the conditions of the example just given (viz. $R_{1,t} > R_{2,t} = R_{3,t} = R_{4,t}$).

$$\bar{m}_{t-1} = \frac{I_{t-1}^m}{M_{t-1}}, \quad \text{where } \bar{M}_{t-1} = M_{t-2} + \Delta M_{1,t-1} \left(\frac{7}{8}\right) \\ + \Delta M_{2,t-1} \left(\frac{5}{8}\right) + \Delta M_{3,t-1} \left(\frac{3}{8}\right) + \Delta M_{4,t-1} \left(\frac{1}{8}\right).$$

The average mortgage portfolio in period $t-1$ is taken to be the mortgages outstanding at the end of period $t-2$ plus a weighted average of the net increases in mortgages in period $t-1$, again with the weights

$$\text{declining. } I_{t-1}^m = M_{t-2} \cdot \bar{m}_{t-1} + \Delta M_{1,t-1} \left(\frac{7}{8}\right) \bar{m}_{t-1} + \Delta M_{2,t-1} \left(\frac{5}{8}\right) \bar{m}_{t-1} \\ + \Delta M_{3,t-1} \left(\frac{3}{8}\right) \bar{m}_{t-1} + \Delta M_{4,t-1} \left(\frac{1}{8}\right) \bar{m}_{t-1}, \quad \text{giving}$$

$$\bar{m}_{t-1} = \frac{I_{t-1}^m}{M_{t-2} + \Delta M_{1,t-1} \left(\frac{7}{8}\right) + \Delta M_{2,t-1} \left(\frac{5}{8}\right) + \Delta M_{3,t-1} \left(\frac{3}{8}\right) + \Delta M_{4,t-1} \left(\frac{1}{8}\right)}.$$

Hence, as the contract rate cannot be changed once it has been agreed to,

$\bar{m}_{t-1} [M_{t-1} - \bar{R}_t]$ represents the amount of interest paid in period t on "old" mortgages. Subtracting from I_t^m , we have interest on new mortgages, which, when divided by \bar{A}_t , gives us the current rate, m_t .

$$\bar{A}_t = \frac{7}{8} A_{1,t} + \frac{5}{8} A_{2,t} + \frac{3}{8} A_{3,t} + \frac{1}{8} A_{4,t}. \quad \text{The loans of the first}$$

quarter will, on average, be outstanding for $\frac{7}{8}$ th of the year, etc. We

note that if $A_{1,t} = A_{2,t} = A_{3,t} = A_{4,t}$, $R_{1,t} = R_{2,t} = R_{3,t} = R_{4,t}$ and

$$\Delta M_{1,t-1} = \Delta M_{2,t-1} = \Delta M_{3,t-1} = \Delta M_{4,t-1} \quad \text{then}$$

$$\bar{A}_t = A_t \left(\frac{1}{2}\right), \quad \bar{R}_t = R_t \left(\frac{1}{2}\right) \quad \text{and} \quad \bar{M}_{t-1} = M_{t-2} + \frac{\Delta M_{t-1}}{2} = \frac{M_{t-2} + M_{t-1}}{2}$$

Our formula then becomes:

$$m_t = \frac{1}{\frac{1}{2} \cdot A_t} \left\{ I_t^m - \frac{I_{t-1}^m}{\frac{M_{t-2} + M_{t-1}}{2}} [M_{t-1} - \frac{R_t}{2}] \right\}$$

$$= \frac{1}{A_t} \left\{ 2I_t^m - \bar{m}_{t-1} [2M_{t-1} - R_t] \right\}$$

if $m_0 = m_1 = \dots m_t$, we have

$$m_t = \frac{1}{A_t} \left\{ 2I_t^m - m_t (2M_{t-1} - R_t) \right\}$$

i.e.,

$$m_t (A_t - R_t - 2M_{t-1}) = 2I_t^m ; m_t = \frac{I_t^m}{M_{t-1} + \frac{A_t - R_t}{2}} = \frac{I_t^m}{\bar{M}_t}$$

From 1958-1964, the figures for advances given in [6] agree closely with the figures given in [18]. We can calculate quarterly figures for repayments from various issues of the Federal Reserve Bulletin and adjust them to agree with [18]. These figures were used to calculate m_t for the years 1959-1964. For earlier years we derived m_t by calculating seasonal indices for A_t , R_t , and ΔM_t on the basis of quarterly figures taken from [6] for A_t and from Federal Reserve Bulletins for R_t and ΔM_t , for the years 1956-1964. The ratio to moving average was the method used and the indices were found to be

	A_t	R_t	ΔM_t
Qr. 1	85.4	92.4	77.5
2	107.4	98.6	118.0
3	110.2	108.5	112.3
4	97.0	100.5	92.2

$$\begin{aligned} \text{Hence } A_{1,t} \left(\frac{7}{8}\right) + \dots + A_{4,t} \left(\frac{1}{8}\right) &\approx A_t \left[\frac{7}{8} (.213) + \frac{5}{8} (.269) + \frac{3}{8} (.276) \right. \\ &\quad \left. + \frac{1}{8} (.242) \right] = A_t (.488) \approx \bar{A}_t \end{aligned}$$

Similarly $\bar{\Delta M}_t \approx \Delta M (.488)$ and $\bar{R}_t \approx R_t (.489)$.

These results were inserted into the formula for m_t , giving m_t for the years 1946-1958.

(2) $m(\text{MSB})$ was calculated from the formula

$$m(\text{MSB})_t = \frac{1}{A_t} \left\{ 2 I_t^m - \bar{m}_{t-1} [2 M_{t-1} - R_t] \right\}$$

using figures taken from [14].

(3) i was calculated by dividing the dividends paid by the average amount of deposits outstanding during the year. Dividends paid are taken from [18, p. 27].

(4) Both V and I^m were taken from various issues of [7]. These figures were then adjusted to get figures applicable for the whole industry using a coefficient of adjustment for each year taken from 18, p. 111, where assets of SLA members of the FHLB System are given as a percentage of the assets of all SLA's. This percentage increased from 89.2 percent in 1947 to 98.4 percent in 1964. I assume that advertising expenditure and interest rate policy were similar as between members and nonmembers.

(5) FHLB estimates of the mortgage rates in 1963 and 1964 are given in [6, pp. 20-21]. These figures do not agree closely with the figures derived above, especially for the year 1963. The calculations produced a mortgage rate which fell from about 6.5 percent in 1962 to about 5.5

percent in 1963. Even though the figures are not fully comparable (the FHLB figures are derived from a sample and deal only with conventional single-family loans), it is difficult to explain the difference. (The 1963 FHLB figure is about 6 percent.) Some evidence to support the values of the calculated mortgage rates used in this study can be found in the Savings and Loan Fact Book (1964) of the U.S. Savings and Loan League, where the 1963 rate is discussed. In 1963 "many lenders were offering conventional loans at rates comparable to those on the insured and guaranteed mortgages" (both $5\frac{1}{4}$ percent). [p. 55]. "A survey conducted by the U.S. Savings and Loan League in February 1964 revealed a downward trend in the rates charged on mortgage loans in 1963. Approximately 60 percent of the reporting associations gave 6 percent as their usual lending rate. However, the percentage of associations with a rate under 6 percent had almost doubled since a year earlier, and the percentage with a rate higher than 6 percent had declined from 26 percent to 19 percent." [p. 72]. Remembering that our figures include the contributions of low yielding F.H.A. and V.A. loans, the computed 1963 figure does not appear to be unreasonable.

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